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ABSTRACT

This paper summarizes the overall theme of a collection of six papers (each with separate commentary) inspired by research in cognitive psychology. The dominant approaches to instructing educationally disadvantaged children have focused on the teaching of basic skills, with little regard for the more advanced skills of reasoning, problem solving, and independent thinking. This collection of papers focuses on alternative models for teaching the advanced skills of mathematics reasoning, reading comprehension, problem solving, and composition. These models represent a new attitude toward disadvantaged ("at risk") learners. The following major themes underlie these approaches: (1) a new attitude toward the disadvantaged learner emphasizing intellectual strengths and accomplishments and acknowledging cultural differences; (2) reshaping the curriculum for relevance and emphasis on advanced skills; and (3) applying new instructional strategies. Specific recommendations are presented for individual teachers, staff developers, program planners and managers, and school and district administrators. A whole-school perspective will be necessary to implement these ideas. It is noted that these models are relevant for all learners, not merely the educationally disadvantaged. One figure and a 12-item list of references are included. (SLD)

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MODELS FOR TEACHING ADVANCED SKILLS TO EDUCATIONALLY DISADVANTAGED CHILDREN

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MODELS FOR TEACHING ADVANCED SKILLS TO EDUCATIONALLY DISADVANTAGED CHILDREN

A fundamental assumption underlying much of the curriculum in America's schools is that certain skills are "basic" and must be mastered before students receive instruction on more "advanced" skills, such as reading comprehension, written composition, and mathematical reasoning. One consequence of adherence to this assumption for many students, particularly those deemed most at risk for school failure, is that instruction focuses on the so-called basics (such as phonetic decoding and arithmetic operations) to the exclusion of reasoning activities and reading for meaning. Demonstrated success on basic skills measures becomes a hurdle that must be overcome before the student receives instruction in comprehension, reasoning, or composition.

Research from cognitive science questions this assumption and leads to a quite different view of children's learning and appropriate instruction. By discarding assumptions about skill hierarchies and attempting to understand children's competencies as constructed and evolving both inside and outside of school, researchers are developing intervention strategies that start with what children know and provide explicit models of proficient thinking in areas that traditionally have been termed "advanced" or "higher order." This volume offers descriptions of six instructional models that appear successful in teaching advanced skills to students who generally would be expected to fare poorly in the typical school program.

Together, these papers comprise a critical mass of evidence that these children and youth, whom we will refer to collectively as educationally disadvantaged students, can profit from instruction in comprehension, composition, and mathematical reasoning from the very beginning of their education. In this summary, we highlight the issues that led to a search for alternative instructional approaches, describe a set of overarching themes that set these approaches off from conventional approaches to compensatory education, and discuss the implementation problems that must be addressed if we are to see use of these approaches in the classrooms that serve the educationally "at risk."

Compensatory Education As It Is Today

The prototypical compensatory education program is offered at the elementary school level. Children who score more poorly than their peers on standardized tests and teacher evaluations—many of them poor and from diverse cultural or linguistic backgrounds—are given special practice in reading, most often in a special pull-out room, sometimes in the regular classroom (Birman et al., 1987). While their classmates are working on reading new materials with comprehension, children in the compensatory program typically receive drill on phonics, vocabulary, and word decoding. Each of

these is taught as a separate skill, with little or no integration. Often there is little or no coordination between the compensatory and regular classroom teachers and no congruence between the content of the two classes.

Compensatory programs in mathematics (second only to reading programs in number) tend to have a similar emphasis on teaching individual lower-level skills. Students practice basic arithmetic operations using workbooks or dittos. On the assumption that they cannot be expected to do even simple math-related problem solving until they have mastered the basics, students are drilled on the same numerical operations year after year.

Results from state and national testing programs suggest that this kind of instruction has had some positive (though not dramatic) effects on student scores on basic skills measures, especially in the early years of elementary school. What has been disheartening is the fact that comparable gains have not been seen on measures of more advanced skills. In fact, despite years of compensatory education, the majority of educationally disadvantaged children appear to fall farther and farther behind their more advantaged peers as they progress in school and a greater emphasis is placed on advanced skills of comprehension, problem solving, and reasoning.

For too long, there has been a tendency to blame this situation on the students. Tacitly or explicitly, it was assumed that they lacked the capability to perform complex academic tasks. Recently, however, there has been a reexamination of the premises underlying the instruction provided to educationally disadvantaged students in general and the most prevalent approaches to compensatory education in particular. Critics point out that we have decried educationally disadvantaged students' failure to demonstrate advanced skills while ourselves failing to provide them with instruction designed to instill those skills (Cole & Griffin, 1987). There is a growing understanding that the failures lie both in the compensatory program per se and in the regular classroom in which educationally disadvantaged students receive the rest of their instruction.

Classroom studies document the fact that disadvantaged students receive less instruction in higher-order skills than do more advantaged students (Allington & McGill-Franzen, 1989; Oakes, 1986). Their curriculum is less challenging and more repetitive. Teachers are more directive with educationally disadvantaged students, breaking each task down into smaller pieces, walking them through step by step, and leaving them with less opportunity to exercise higher-order thinking skills. As a consequence, disadvantaged students receive less exposure to problem-solving tasks in which there is more than one possible answer and they have to structure the problem for themselves (Anyon, 1980).

A recent summary of the critiques of this kind of instruction offered by a group of national experts in reading, writing, and mathematics education (Knapp & Turnbull, 1990) concluded that such approaches tend to:

- Underestimate what disadvantaged students are capable of doing.
- Postpone more challenging and interesting work for too long—in some cases, forever.
- Deprive students of a meaningful or motivating context for learning or for using the skills that are taught.

Why the Prevailing Emphasis on Lower-Level Skills?

The critique outlined above suggests that the dominant approaches to instructing educationally disadvantaged children are in fact holding them back—providing little or nothing to foster the growth of reasoning, problem solving, and independent thinking. Our goal in this volume is to offer some concrete alternatives to prevailing approaches, but before turning to those alternatives, it is important to consider the reasons why educationally disadvantaged students are now taught the way they are. A thorough understanding of the theoretical tenets and organizational factors that support the current curriculum and instruction in compensatory education is needed if we are to design and implement alternative models of instruction.

A critical theoretical assumption underlying much of the curriculum and instruction provided to educationally disadvantaged students is that academic skills are hierarchical in nature. Some skills are "basics," and these must be mastered before more "advanced," "higher-order," or "complex" skills can be attained. This presumption is very deeply ingrained in the American curriculum. Thus, it is assumed that the basics of vocabulary and phonics must be mastered before students work on reading comprehension skills or critical literacy. In the area of writing, the mechanics of penmanship, grammar, and spelling are treated as prerequisites for learning to compose. The math curriculum presupposes that learning to execute basic numerical operations with accuracy and some speed is necessary before tackling problems that require reasoning with mathematics. Once this assumption of a skills continuum from basic to advanced is adopted, compensatory education's focus on basic skills seems eminently reasonable.

This assumption about a skills hierarchy pervades the instructional and testing materials available to educators. Anyone attempting to implement an alternative instructional approach incorporating advanced skills throughout the curriculum must be prepared to face the barrier of a scarcity of compatible textbooks.[1] Today's reading

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[1] We are beginning to see indications of a change in this situation, as textbook publishers respond to the critiques of educational reformers such as the National Council of Teachers of Mathematics (NCTM).

texts are generally structured as a strict sequence of skills, beginning with phonetic decomposition and vocabulary. Math programs start with arithmetic operations performed on small numbers and proceed through a fairly standard hierarchy, with applications of math to real problems postponed until the necessary operations can be performed with consistent accuracy on abstract content. Thus, following the textbook results in treating discrete basic skills as a prerequisite for exposure to more complex, meaningful tasks.

The same thinking underlies the design of educational tests. Basic skills are emphasized in tests for students in the early elementary grades, with more advanced content added in later years. Even then, the minimum-competency movement and the difficulty in measuring meaningful higher-order tasks with economical paper-and-pencil measures have led to an emphasis on measuring discrete components of complex tasks rather than the tasks themselves (e.g., grammar rather than composition). It is only natural that schools that are held accountable for student performance should tend to orient their curricula around the content of those tests.

Mastery learning approaches bring curriculum content and classroom assessment together in a unified system that requires students to demonstrate achievement of lower-level skills before going on to receive instruction on advanced skills. Instructional packages based on this approach institutionalize mastery of basic skills as a prerequisite for getting instruction in skills considered more advanced.

One point made by the papers in this volume is that we have been too accepting of the assumption that mastery of the skills traditionally designated as basic is an absolute prerequisite for learning those skills that we regard as advanced. Consider the case of reading comprehension. Cognitive research on comprehension processes has shown the importance of trying to relate what you read to what you already know, checking to see that your understanding of new information fits with what you have already read, setting up expectations for what is to follow and then seeing whether they are fulfilled. The research described by Palincsar and Klenk (this volume) demonstrates quite clearly that students can acquire these comprehension skills—which we have traditionally called advanced—well before they are good decoders of the printed word. Children can learn to reason about new information, relate information from different sources, ask questions, and summarize using orally presented text. We may or may not want to call these comprehension skills advanced, but it is clear that children—including educationally disadvantaged children—can acquire and exercise them before they master all of the so-called basics. Similarly, Peterson, Fennema, and Carpenter (this volume) describe research showing that first-graders can solve a wide variety of math problems, using modeling and counting, before they have perfected the computational algorithms that are traditionally regarded as prerequisites. Likewise, Calfee (this volume) points out that children can perform sophisticated composition tasks before they have acquired the mechanics of writing.

In the early school years, children's achievement is typically measured in terms of their ability to perform basic skills in an academic context. Skills are formally assessed—children are asked to perform independently and to execute the skills for their own sake, not as part of any task they are trying to accomplish. Children from impoverished and linguistically different backgrounds often perform poorly on these assessments. Their performance leads educators to conclude that they are severely deficient academically, a conclusion predicated on the assumption that the skills being tested provide the necessary foundation for all later learning.

Ironically, the decontextualized measures of discrete skills that we have come to regard as basic offer less opportunity for connecting with anything children know from their past experiences than would more complex exercises emphasizing the skills we regard as advanced. To prepare them for writing, children from diverse linguistic backgrounds are drilled on the conventions of written standard English. These will be harder for them than for other children because the conventions often conflict with the children's spoken language (Scott, 1988). On the other hand, a task that focuses on higher-level issues of communication—for example, formulating a message that will be persuasive to other people—is perfectly consistent with many of the child's out-of-school experiences. At the level of language mechanics and communication formats, there are many inconsistencies between the backgrounds of many disadvantaged children and the conventions of the schoolhouse, but at the higher level of communication goals, there is much more common ground.

A similar argument can be made about reading instruction. Young readers deemed at risk of school failure are subjected to more drill and tighter standards regarding their pronunciation in oral reading (Allington, 1980; Brophy & Good, 1974). These children must struggle with a pronunciation system that is different from that of their spoken language or dialect at the same time that they are trying to master basic reading. When it comes to comprehension skills, on the other hand, we have every indication that disadvantaged children can make use of their past experiences to help them understand a story. Palincsar and Klenk provide examples of young children regarded as academically "at risk" applying their background knowledge to make inferences about text. In one such example, a first-grade girl uses her prior knowledge about seasons to make inferences while listening to a story about a baby bear who played too roughly with his sister and fell off a tree into the water: "You know it kind of told you what time of year it was because it told you it went 'splash' because if it was this time of year [February], I don't think he'd splash in the water, I think he'd crack." This inference making is exactly the kind of comprehension-enhancing strategy we regard as advanced. Real-life experiences and skills are relevant to these higher-level academic skills. Instruction in advanced skills offers opportunities for children to use what they already know in the process of developing and refining academic skills.

Compensatory Education As It Could Be

This volume contains six commissioned papers describing alternative models for teaching advanced skills of mathematics reasoning, reading comprehension, problem solving, and composition to educationally disadvantaged students. These models represent a new attitude toward learners who have been labeled "disadvantaged" or "at risk," a fundamental rethinking of the content of the curriculum, and a set of instructional strategies that allow children to be active learners but do not require them to work in isolation. Although the chapters describe different academic content and different grade levels, we can extract the major themes emerging from the set. These themes are summarized in Figure 1 and discussed below.

A New Attitude Toward the Disadvantaged Learner

The instructional models described in this volume reflect a new attitude toward the educationally disadvantaged learner. Rather than starting with a list of academic skills, administering formal assessments, and cataloging children's deficits, these researchers start with the conviction that children from all kinds of backgrounds come to school with an impressive set of intellectual accomplishments. This conviction is bolstered by years of research in cognitive psychology and linguistics. When we start to do a detailed analysis of what it means to understand numbers, what it takes to master the grammar of a language, what is required to be able to categorize and recategorize objects, we come to appreciate the magnitude of young children's intellectual accomplishments. When we look closely at how these kinds of understanding are achieved, we begin to understand that concepts are not something given to the child by the environment but rather are constructed by the child who interacts with that environment.

Children from poor and affluent backgrounds alike come to school with important skills and knowledge. They have mastered the receptive and expressive skills of their native language. The particular language or dialect they have acquired may or may not match that of the classroom, but the intellectual feat is equivalent. They have learned basic facts about quantity, for example, the fact that rearranging objects does not change their number. They have learned much about social expectations, such as the need to take turns talking when participating in a conversation. Moreover, they have a host of knowledge about the world: grocery stores are places where you pay money for food, new flowers bloom in the spring, night time is for sleeping.

Instead of taking a deficit view of the educationally disadvantaged learner, the researchers developing the alternative models described here focus on the knowledge, skills, and abilities that the child brings. Early accomplishments, attained before coming to school, demonstrate that disadvantaged children can do serious intellectual work. What we need to do is design curricula and instructional methods that will build on that prior learning and complement rather than contradict the child's experiences outside of school.

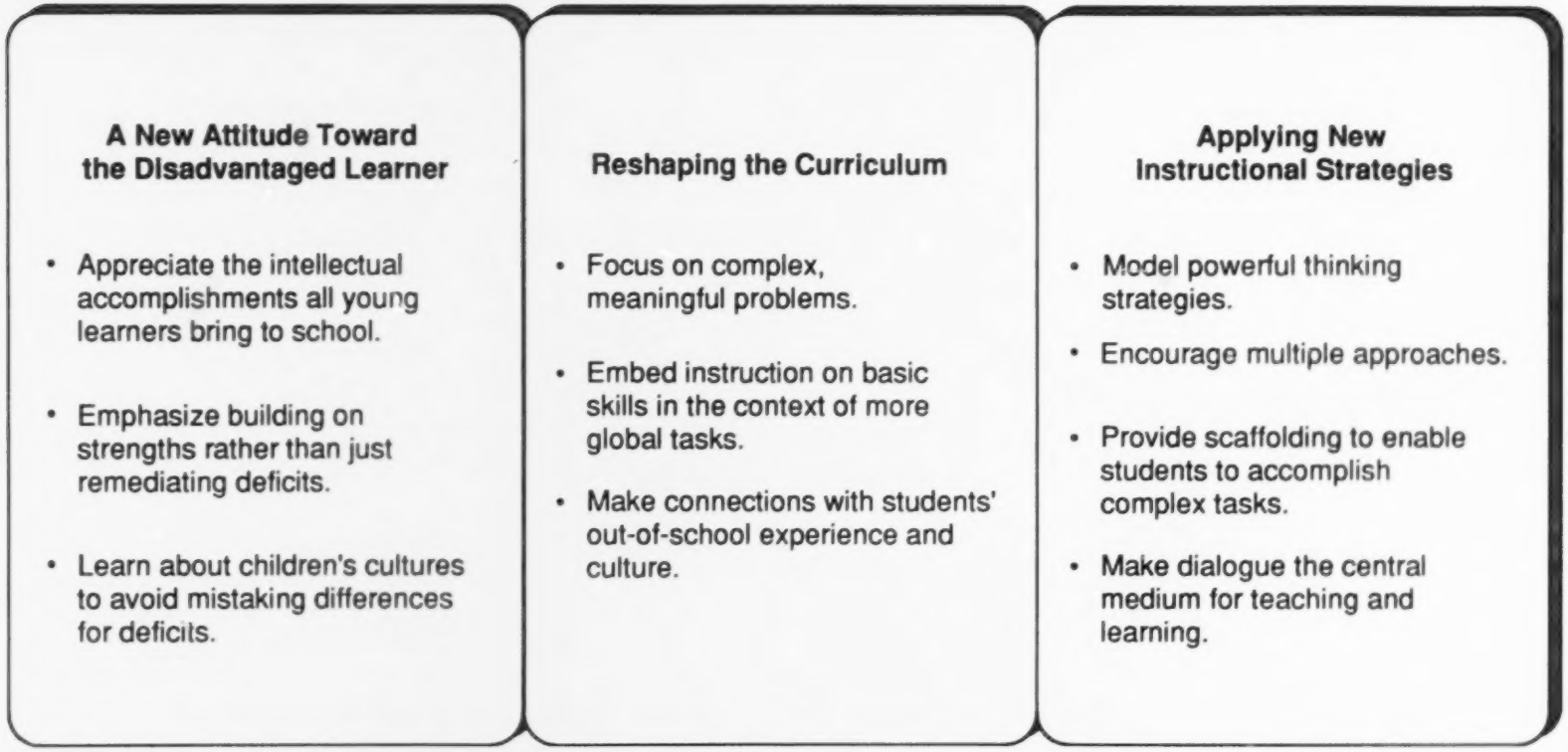
A New Attitude Toward the Disadvantaged Learner
• Appreciate the intellectual accomplishments all young learners bring to school.
• Emphasize building on strengths rather than just remediating deficits.
• Learn about children's cultures to avoid mistaking differences for deficits.
Reshaping the Curriculum
• Focus on complex, meaningful problems.
• Embed instruction on basic skills in the context of more global tasks.
• Make connections with students' out-of-school experience and culture.
Applying New Instructional Strategies
• Model powerful thinking strategies.
• Encourage multiple approaches.
• Provide scaffolding to enable students to accomplish complex tasks.
• Make dialogue the central medium for teaching and learning.

FIGURE 1 PRINCIPLES OF COGNITIVE APPROACHES TO TEACHING ADVANCED SKILLS TO DISADVANTAGED STUDENTS

Reshaping the Curriculum

The instructional approaches described in this volume eschew the assumption that students cannot meaningfully engage in activities involving advanced skills of comprehension, composition, and reasoning unless they have mastered the so-called basic skills. Once the conventional assumption about a necessary skills hierarchy has been abandoned, a new set of curricular principles follows.

Focus on Complex, Meaningful Problems—The dominant curricular approach over the last two decades has broken academic content down into small skills, with the idea that each piece would be easy to acquire. An unfortunate side effect is that by the time we break something down into its smallest parts, the whole is often totally obscured. Children drill themselves on the spelling and definitions of long lists of words, often without really understanding the words' meanings or having any motivation for using them. High school students practice computations involving logarithms, but leave school with no idea of what the purpose of logarithms is or how they might aid in solving practical problems (Sherwood, Kinzer, Hasselbring, & Bransford, 1987).

The alternative is to keep tasks at a global enough level that the purpose of the task is apparent and makes sense to students. Thus, children might write their city council in support of a public playground. In the course of the exercise, they may need to acquire new vocabulary (*alderman, welfare, and community*), but each word would be acquired in a context that gave it meaning. At the same time, children would be attending to higher-level skills. What are the arguments for a good playground? Which of these arguments would be most persuasive to a politician? What counter arguments can be expected? How can these be refuted?

The programs described in this volume abound with examples of providing students with more global, complex tasks. Collins, Hawkins, and Carver describe a math and science curriculum organized around the problem of understanding motion. Students engage in extended investigations of topics such as the physical principles of motion underlying an amusement park ride of their own design or a foul shot in basketball. Vye et al. describe a program using interactive video to present students with complex problem situations, such as moving a wounded eagle to a distant veterinarian by the safest and fastest route. A whole series of rate, fuel consumption, and distance problems must be recognized and solved in the process of devising a plan.

Certainly these tasks are more complex than simple computations or phonics exercises, but there are instructional techniques (described below) that lessen the burden on any one student. Moreover, as we argued above, these more complex tasks build on things that students already know.

Embed Instruction on Basic Skills in the Context of More Global Tasks—Teaching advanced skills from the beginning of a child's education does not mean failing to teach those skills generally called basic. Rather, what these alternative approaches advocate is using a complex, meaningful task as the context for instruction on both advanced and basic skills. Instead of constant drill on basic addition and subtraction facts, these skills are practiced in the context of trying to solve real problems. Peterson et al. (this volume) describe the pedagogical use of problems stemming from daily classroom activities—for example, figuring out how many children will be having hot lunches and how many cold lunches at school that day. Children can practice addition, subtraction, fractions, and record keeping in the course of this authentic classroom activity.

There are multiple advantages to this approach. First, the more global task provides a motivation for acquiring all the knowledge and skills entailed in its accomplishment. It is worth learning the conventions of writing if that will enable you to communicate with a distant friend. Word decoding is much more palatable if the word is part of a message you care about. Second, embedding basic skills in more complex task contexts means that students receive practice in executing the skill in conjunction with other skills. One of the things cognitive research on learning has shown is that it is possible to be able to perform all the subskills of a task without being able to put the pieces together into any type of coherent performance. Cognitive psychologists call this the problem of orchestration. The ability to orchestrate discrete skills into performance of a complex task is critical. After all, the desired outcome of schooling is not students who can perform arithmetic calculations on an arithmetic test but students who can use these skills in performing real-world tasks. The latter will require that the calculations be performed in conjunction with the higher-level skills of problem recognition and formulation.

Finally, teaching basic skills in the context of more global, meaningful tasks will increase the probability that those skills will transfer to real-world situations. The decontextualized academic exercises within which many basic skills have been taught are so different from what any of us encounter in the everyday world that it is little wonder students question the relevance of most of what they learn in school. Some students come to accept the idea of performing academic exercises for their own sake. Others reject the whole enterprise. Neither group could be expected to use what they learned in school when they encounter problems in their everyday lives. Thus, we have students who learn to find the lowest common denominator in order to complete exercises with mixed fractions but who have no idea how these operations might be used in everyday carpentry or cooking. Much classroom instruction focuses on how to execute a skill without adequate attention as to when to execute it. Students learn how to make three different kinds of graphs but receive no instruction or practice in deciding what kind of graph is most useful for what purpose. This issue of how to decide which

skill to apply does not come up when skills are taught in isolation; it is unavoidable when skills are taught in a complex, meaningful task context.

Make Connections with Students' Out-of-School Experience and Culture—Implicit in the argument above is the notion that in-school instruction will be more effective if it both builds on what children have already learned out of school and is done in such a way that connections to situations outside of school are obvious. Resnick, Bill, Lesgold and Leer (this volume) describe a program in which young children are not only given realistic problems to solve with arithmetic in class but are encouraged to bring in their own real-life problems for their classmates to solve.

At the same time, it is important to recognize that there is great cultural diversity in the United States and that many children in compensatory education come from homes with language, practices, and beliefs that are at variance with some of those assumed in "mainstream" classrooms. Moll (1990) argues that the strengths of a child's culture should be recognized and instruction should capitalize on them. He describes an intricate network for sharing practical knowledge and supporting acquisition of English skills within a Hispanic community. This cultural practice of knowledge sharing can become an effective model for cooperative learning and problem solving in classrooms. Bryson and Scardamalia (this volume) argue that students can learn to use writing as a medium for thinking while working on literary forms that are compatible with their particular cultural background. An example is provided by Griffin and Cole (1987), who had black students compose rap lyrics in collaborative sessions using computers. Although rap is not a form of literature found in many standard textbooks, it is no different from the sonnet in terms of having a structure and set of conventions. When working with this form, which was both relevant to their culture and motivating, black students from low-socioeconomic-status homes demonstrated a high degree of sophistication in their composition and revision skills.

Applying New Instructional Strategies

The rethinking of the curriculum described above must be matched by a change in the methods that are used to impart that curriculum. The programs described in this volume stress teaching methods that are quite different from the structured drill and practice that typifies most compensatory education.

Model Powerful Thinking Strategies—With its focus on teaching cognitive (as opposed to physical) skills, research in cognitive psychology has long been concerned with making the thinking of expert performers manifest. A key goal has been to understand the processes that expert performers use in addressing complex tasks and solving novel problems and to explicitly model these processes for novice learners. Great strides have been made in understanding the strategies that accomplished readers use to monitor and enhance their understanding of what they read, that

mathematicians use when faced with novel problems, and that skilled writers employ. The research described in this volume demonstrates the instructional value of making these strategies explicit for learners.

All of the authors recommend that teachers explicitly and repeatedly model the higher-order intellectual processes they are trying to instill in their students. This means thinking out loud while reading a text and trying to understand how the information in it fits with previously known facts, externalizing the thought process in trying to solve a mathematical puzzle, demonstrating the planning and revision processes involved in composition. For too long we have shown students the product they are supposed to achieve (e.g., the right answer to a math problem or a polished essay) without demonstrating the critical processes required to achieve it.

Encourage Multiple Approaches—The alternative programs differ from the instruction conventionally provided in most classrooms in their encouragement of multiple solution strategies. Rather than trying to teach the one right way to solve a problem, these programs want to foster students' ability to invent strategies for solving problems themselves. In some cases, this kind of thinking is elicited by providing students with open-ended problems to which there is no single right answer. Given the assignment to develop a description of one's city that would attract other people to live there, for example, students are free to follow very different paths and to produce different kinds of solutions. In other cases, such as elementary mathematics, problems do have one correct solution. Still, there is more than one way to reach that solution, and one of the clearest demonstrations of real understanding of mathematics concepts is the ability to use those concepts to invent solution strategies on one's own.

To support the development of this essential component of problem solving, the programs described here invite students to think of their own ways to address a problem. In a classroom described by Peterson et al. (this volume), for example, small groups of students are given mathematics problems that each solves individually. As each child finds an answer, the teacher asks him or her to describe how the problem was solved. When all students have finished, the students' different paths to the answer are compared and discussed so that students can see alternative approaches modeled and come to realize that there is no single right way to find the answer.

Provide Scaffolding to Enable Students to Accomplish Complex Tasks—On reading our recommendation that disadvantaged students be presented with authentic, complex tasks from the outset of their education, a natural reaction would be concern about how they will handle all the requirements for such tasks. We need to be sensitive to the fact that many of the components of the task will be difficult and require mental resources. How is the student, particularly the young student, to handle all of this?

A key instructional concept is that of scaffolding—enabling the learner to handle a complex task by taking on parts of the task. One example of scaffolding is the

instructor's performing all the computations required when first introducing students to algebra problems. Another, described by Bryson and Scardamalia (this volume), is scaffolding of the writing process by supplying novice authors with cue cards reminding them to do things such as consider alternative arguments. The reciprocal teaching program described by Palincsar and Klenk (this volume) uses many kinds of scaffolding. In the early stages of teaching, the teacher cues the students to employ the various comprehension-enhancing strategies, leaving students free to concentrate on executing those strategies. A more extensive form of scaffolding is provided for students who have yet to master decoding skills: the teacher reads the text orally, allowing students to practice comprehension strategies before they have fully mastered word decoding.

Like the physical scaffolding that permits a worker to reach higher places than would otherwise be accessible, instructional scaffolding makes it possible for students to accomplish complex tasks with assistance from the teacher, special materials, or other students. The ultimate goal, of course, is for the student to be able to accomplish the task without assistance. This requires the judicious removal of the teacher's support as the student gains more skill.

Make Dialogue the Central Medium for Teaching and Learning—In conventional modes of instruction, the key form of communication is transmission—the teacher has the knowledge and transmits it to the students. Just as the television viewer cannot change the content of a TV program transmitted to his home, the student is viewed as the passive recipient of the message the teacher chooses to deliver. The student can pay attention or not, but the message will be the same regardless. A dialogue is a very different form of communication. It connotes an interchange in which two parties are full-fledged participants, both with significant influence on the nature of the exchange. This concept of dialogue is central to the programs described here.

Reciprocal teaching occurs through dialogue—initially between the teacher and a small group of students, later among the students themselves. The specifics of the instructional content emerge in the back-and-forth interchange between teacher and students. Similarly, Peterson et al.(this volume) describe how student-teacher dialogue provides the basis for teachers to diagnose each student's level of understanding and design appropriate mathematics problems. Collins et al. (this volume) provide an example of the value of student-student dialogue: students who had developed hypermedia information displays found that students from another school were bored by the work they had regarded as exemplary. This experience led the student developers to look at their work from an audience's perspective and to undertake design changes to make their product better.

How Do Such Reforms Happen?

The papers presented in this volume provide a concrete picture of alternative models for teaching advanced skills to disadvantaged students. We are fully aware, however, that there are many steps and roadblocks between enthusiasm for a new approach and effective implementation. We are also aware that, while conceptually well grounded in modern learning theory, most of the interventions have not been extensively evaluated in a wide variety of settings. Nonetheless, the practical trials summarized in this volume suggest that these intervention models can work anywhere and should be tried more widely. Here, we consider what individual teachers, staff developers, compensatory program managers, and school or district administrators can do to experiment with and adopt such reforms. All these individuals have an important role to play. Furthermore, implementing new approaches to teaching advanced skills to a particular segment of the student population—the educationally disadvantaged—implies adjustments in the academic program for all students.

What Individual Teachers Can Do in Their Classrooms: Experiment with New Approaches

Whether they work in a regular classroom or a separate compensatory education setting, individual teachers can do much to bring about the changes discussed in this volume. Using knowledge about children's understanding and the processes and strategies that support performance of advanced skills, they can select or develop more challenging problems for their students. They can seek "authentic" problems as a context for teaching and practicing skills, often combining reading comprehension with mathematics, writing with science, and so on. They can consciously provide their own thinking processes as models and probe students to get at their thinking. They can become knowledgeable about their students' culture and seek to develop problems and activities that will draw on the strengths of that culture. They can develop classroom assessment techniques that get at higher-order skills and the ability to apply them to novel content rather than the dutiful repetition of designated phrases or stereotypic procedures. Finally, they can work with other teachers to share interesting problems and techniques and to make connections across the different subject areas and classrooms to which students are exposed.

For most teachers, these ways of approaching students, instruction, and assessment are unfamiliar. To realize them in the classroom implies considerable experimentation, once teachers have a clear concept of the approach in mind. The most adventurous of teachers will pick up the ideas on their own, but the large majority will need help and support. Staff developers have a particularly important role to play in this regard.

What Staff Developers Can Do: Provide Teachers with Appropriate Learning Experiences

Staff development opportunities are one of the most direct—and potentially powerful—ways for teachers to become attuned to new ways of teaching. Here, we consider the kinds of experiences teachers need to prepare them for new approaches to teaching advanced skills.

The same principles underlie learning new approaches to teaching as underlie student learning in the classroom. In the view of cognitive psychologists, human learning is not a matter of passive absorption of whatever information an instructor happens to provide. Rather, it involves an active role on the part of the learner, who tries to make sense of new information in terms of what he or she already knows. The way in which the new information is understood, the extent to which it is remembered, and the degree to which it will have an impact on future behavior depend on the learner's prior knowledge and the connections that are made between new information and old. Thus, the learner is actively engaged both in assimilating the new knowledge and, if there are inconsistencies with old knowledge, restructuring or refining prior understandings to incorporate the new concept.

This is just as true of teachers as of their pupils. The way in which teachers will understand and apply innovative teaching approaches depends on the way those approaches fit in with their prior knowledge and beliefs. If the alternative approaches require a fundamental reshaping of those beliefs, teachers will have to be provided with a great deal of evidence and some experience applying the new approaches before real change in their views and behaviors is possible.

The alternative models of curriculum and instruction described here differ from conventional compensatory education in their underlying assumptions about the capability of educationally disadvantaged students to exercise sophisticated comprehension, composition, and math reasoning skills. Many teachers have lower expectations for educationally disadvantaged children, whether because they believe that some children's backgrounds leave them inherently limited or because they believe that advanced skills cannot be acquired until all the basics are mastered. An important part of preparing teachers for these alternative models is changing this belief. This is not effectively accomplished by telling teachers to change. Rather, teachers need the experiences that will lead them to new conclusions about children's capabilities. Videotapes of children engaging in sophisticated comprehension strategies or reasoning about novel mathematics problems have proved very useful in this regard.

In addition to an alteration in conceptions about the capabilities of educationally disadvantaged students, a change in well-learned methods of teaching is required. Many of the instructional techniques described in the papers in this volume are quite different from those with which most teachers themselves were taught in school or those

stressed in teacher training. The techniques of modeling, coaching, and providing for reflection on performance are just as relevant when teaching these instructional techniques to teachers as they are when trying to teach children. Those responsible for inservice training need to model skills such as interviewing children to get at their level of understanding. Teachers then need to practice this kind of interaction with real students. Teachers who are expert in these techniques can act as coaches, providing support during the interview and offering detailed critiques of transcripts or videotaped interviews. At the same time that teachers are gaining skill in this kind of interaction, they also gain more information about what students do and do not understand. This experience can help them appreciate the importance of the concepts children bring to school and at the same time perceive the cases where school-taught procedures fail to connect with children's intuitive knowledge.

Similarly, these techniques of modeling and coaching can be applied to helping teachers learn how to model their own thinking and provide scaffolding to students as they work in specific task areas. Teachers need the opportunity to try out these instructional techniques and to receive feedback on the strengths and weaknesses of their efforts.

Both the literature on professional development and school change and cognitive learning theory suggest that teachers will understand and embrace a system more thoroughly if they have had a role in shaping it. We recommend that, rather than adopting an instructional package in its entirety, teachers and their administrators work together to adapt the instructional principles discussed here in ways that fit their particular teaching situations and then develop or adapt curricula and techniques that embody those principles. In this volume, we have provided descriptions of models for instruction, but any of them would have to be thought through and refined to fit the goals and circumstances of a particular classroom and school.

What Program Planners and Managers Can Do: Incorporate New Approaches Into the Design of Compensatory Programs

Compensatory education teachers rarely operate with a free rein to fashion a curriculum as they see fit. More often, they teach their students as part of a program designed at the school district level, in response to state and federal program requirements and guidelines. The program is often fine-tuned within the school building, however, and, depending on the relationship between compensatory teachers and those in the regular classrooms, may be adapted to suit the needs of particular teachers and classes.

The design of a compensatory education program has much to do with the prospect that the ideas presented in this volume will take root. Program planners and staff will need to consider, for example:

- *The emphasis placed on discrete basic skills in compensatory program objectives and materials.* Despite rhetorical support for advanced skills teaching, the materials and even the specific objectives of the program may still emphasize isolated skill teaching. Careful attention must be paid to the details of the compensatory education curriculum if it is to increase students' exposure to advanced skills significantly.
- *The use of tests or other assessment devices that tap only the students' grasp of basic skills.* Compensatory education programs may subvert their own attempts at teaching advanced skills by using and judging their effectiveness on measures that tap basic skills primarily. Alternative measures tapping advanced skills as described in this volume are not always available, but wherever possible, emphasis should be given to those available measures that aim most closely toward advanced skills (e.g., reading comprehension subscores as opposed to measures of language mechanics or decoding, math concepts and applications subscores rather than math computation).
- *The use of staff (e.g., aides) who lack the training to teach advanced skills.* Choices of compensatory education staffing need to be made with attention to the capabilities of staff—current and potential—for teaching advanced skills and to the resources required to train staff in appropriate techniques. This is a major issue in many compensatory programs, especially those favoring the use of in-class paraprofessional aides.
- *Limitations on the range of curriculum that falls within the purview of the compensatory program.* Often the content domain stipulated for compensatory education is too restricted to encompass some of the interdisciplinary approaches we have advocated for teaching advanced skills. A prime example of such limitations is the failure to include writing in most compensatory language arts programs, effectively depriving students of an important class of higher-order thinking experience that can not only impart skills in written expression but also facilitate learning to read.
- *Connections with the regular academic program.* Compensatory programs are linked to varying degrees with a regular academic program, which may or may not feature or encourage the kind of advanced skills teaching described in this volume. Doing a good job of teaching advanced skills implies closer coordination of regular and compensatory instruction than happens in many settings currently, assuming the regular academic program is designed to foster the learning of advanced skills.

These considerations are generally within the control of local program planners and coordinators, in collaboration with staff who are responsible for the regular academic program. The challenge is to explore the implications of the instructional models presented in this volume for all aspects of compensatory education program design and implementation.

What School and District Administrators Can Do: Develop a Supportive Framework in the Regular Academic Program

The kinds of approaches described in this volume imply other forms of school and district support besides appropriate staff development and compensatory program design. As noted earlier, compensatory programs are usually intended to supplement the regular academic program. The skills learned by educationally disadvantaged children are the joint result of their experience in the regular classroom and supplemental program settings. Therefore, the school and district policies that govern curriculum, scheduling, assessment, and other features of the regular academic program are intimately connected to the prospects for better teaching of advanced skills to the disadvantaged and to other children as well.

At a minimum, school and district policies need to foster professional interchange between regular and compensatory teachers and provide the requisite learning time for both. Developing a network of teachers who can model new approaches and help train their colleagues is vital. Administrators need to develop mechanisms for providing release time so that teachers can attend training and develop new instructional materials for their classes. Strategies that have been used include providing for team teaching, hiring substitutes, or using administrators to teach some classes while teachers are participating in training and development activities. Similarly, arrangements (e.g., videotaping classes, hiring substitutes) that enable teachers to experience each other's classrooms promote coherence across the educational program and make it possible for teachers to learn from each other.

But a more extensive review of policies governing the regular academic program is also called for to ensure that the structure, philosophy, and support systems built into the regular academic program reinforce the teaching of advanced skills. Thus, a set of considerations must be addressed in the regular program as in the compensatory program:

- *Organization of the school day.* School structures that divide the curriculum into discrete pieces with only 20 to 50 minutes for a given subject limit the teaching of advanced skills. The kinds of complex, authentic tasks we are advocating often take much more extended time to address and involve more than one academic domain.
- *Curricula.* State or local curricula and instructional materials that enforce a rigid sequence of discrete basic skills make it difficult to engage in extended instruction of the sort described here. Requirements to use a basal reader or to use different materials for regular and compensatory education can hinder implementation of these models.
- *Testing and assessment.* Testing programs that emphasize basic skills and do not assess higher-order thinking or extended samples of intellectual performance (e.g., writing) convey a message that advanced skills are unimportant.
- *How teachers are viewed.* Administrators' views that many teachers are not capable of offering more challenging, dynamic instruction foreclose the possibility that teachers will be pushed or encouraged to grow.

- *Resources to support changes in practice.* Lack of release time for developing new curricula and instructional materials or for sharpening instructional skills limits teachers' exposure to the kind of models discussed in this volume and makes it highly unlikely that any real change in teaching content or strategies will take place.

The innovations we are advocating need to permeate educationally disadvantaged students' regular classrooms as well as their compensatory programs. In this regard, it is important to note that our recommendations for teaching advanced skills to educationally disadvantaged students apply equally well to other students. The disadvantaged students' current program offers the starkest contrast to the kind of teaching advocated in this volume; but we would argue, as have many others, that all students experience too little coherent instruction dealing with real problems and calling for meaningful application of ideas and skills. Thus, the kinds of innovations recommended for educationally disadvantaged students would be advantageous for other students as well.

A Whole-School Perspective on Teaching the Educationally Disadvantaged

When one considers what teachers, staff developers, program managers, and school administrators can do to implement the kinds of approaches described in this volume, it soon becomes clear that whole-school solutions are especially powerful. Calfee (this volume) argues that effective implementation of the kinds of instructional models described in this volume requires change not just on the classroom level but also in the school as a whole. He urges that the kind of dialogue that becomes the medium of exchange in the classroom be adopted among teachers and between teachers and administrators as well. In addition to raising its expectations for educationally disadvantaged students, the school must provide a coherent program that places sustained intellectual effort above categorical distinctions among subject areas or between regular and compensatory programs.

Compensatory education programs are evolving in ways that encourage whole-school solutions, and administrators should give increased attention to schoolwide programs as a mechanism for innovation. Chapter 1 regulations permit such programs, in which funds are used to support instructional innovations that will help all students, including those who otherwise would have received separate Chapter 1 services. School, district, and state reform efforts and Chapter 2 programs are providing additional sources of support for new approaches to education.

Any schoolwide approach must confront questions about the role of assessment in promoting advanced skills. A requirement for schoolwide Chapter 1 programs is that they be able to demonstrate that those children eligible for Chapter 1 services do as well as or better than they would have done given separate services. This generally requires use of nationally normed tests, and raises the issue of the congruence between what the

program is trying to teach and what the tests are measuring. Although many of the standardized tests given now tend to emphasize discrete basic skills, there are several reasons to believe that schools instituting alternative programs aimed at teaching advanced skills will be able to make their case.

First, although the programs described here have inculcation of advanced skills as their primary focus, the more discrete basic skills that tend to be measured by most standardized tests are dealt with in the context of more complex tasks. The evidence that is available suggests that students involved in the type of program described here often do as well or better on tests of basic skills than do students participating in more traditional programs of drill and practice on basic skills. Second, test developers are moving toward including meaningful measures of advanced skills (extended reading passages, writing samples) on their instruments, and such tests can be expected to become more available and more widely used in the next five years. Finally, the movement toward "authentic" or "performance" testing both signals increasing state and federal interest in measuring advanced skills and provides support for schools' use of supplementary evidence, such as portfolios or locally developed tests, to substantiate the claim that students have made progress in the advanced skills that are the focus of alternative programs.

Conclusion

The papers presented in this volume attest that much more can be done in teaching comprehension, composition, and math reasoning to educationally disadvantaged students than most compensatory education programs have done in the past. It is time to rethink our assumptions about the relationship between basic and advanced skills and to examine critically the content and teaching methods we bring to the classroom. The models described in these papers were inspired by research in cognitive psychology and focus on teaching the kind of content generally regarded as "conceptual," "higher order," or "advanced." The curricular emphasis and some of the instructional elements of these models have long been accepted as appropriate for teaching gifted children, older students, or those from educationally advantaged backgrounds. What has not been adequately appreciated is the relevance of these models for all learners—advantaged and disadvantaged, young and old alike. It is our hope that these papers will serve as a resource and an inspiration for educators who are undertaking the hard work involved in providing students with a new, more challenging educational experience.

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